

## **REMARKS/ARGUMENTS**

### **I. Introduction:**

Claims 1, 11, 14 19, 23, and 27 are amended herein. Claims 1, 2, 4, 6-9, 11, 14, 15, 18-20, 22-25, 27-29, 31, and 33-41 are currently pending.

### **II. Claim Rejections under 35 U.S.C 103:**

Claims 1, 2, 4, 6-9, 11, 14, 15, 18-20, 22-25, 27-29, 31 and 37-41 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,757,255 (Aoki et al.) in view of U.S. Patent No. 6,657,987 (Kumar et al.).

Claim 1 is directed to a method of estimating periodic worst-case delay for a traffic aggregate having an associated rate in a packet switched computer network. Claim 1 has been amended to clarify that the traffic data is collected at a queue of a router, that the burst parameter is calculated based on traffic data collected at the queue, and that the traffic data comprises arrival time and size of packets arriving at the queue.

Aoki et al. disclose an apparatus for measuring communication performance. The apparatus measures the performance in the TCP communications on a communications route of a network. An average value of round trip times is obtained based on a small number of measurement-oriented packets at an interval of fixed time, a maximum segment size obtained based on a packet size of the packets transmitted and received, and a maximum congestion window size estimated from a time change in the round trip time, are used as performance indexes.

Aoki et al. obtain performance indexes of a round trip based on direct measurement of packets transmitted and received. Direct measurement, as used in

Aoki et al. is cumbersome and provides only information about current conditions. It does not predict how the system will perform under different traffic conditions, or how the system will perform with a different allocation of resources. Being able to analyze network performance under hypothetical conditions is useful, for example when a customer and internet service provider agree to the customer sending increased voice and video traffic. Such traffic is burstier than data traffic. Applicant's invention, as set forth in the claims, is particularly advantageous in that it can be used to estimate the effect of an increase in bursty traffic on delay and obtain an estimate of periodic worst-case delay in a way that is scalable to large networks, and does not disrupt normal network performance. There is no discussion in Aoki et al. of calculating a burst parameter for collected traffic. As noted by the Examiner, Aoki does not disclose calculating a burst-rate traffic profile or worst-case delay.

The Kumar et al. patent is directed to scheduling in a Time Division Duplex (TDD) wireless communication network. A method disclosed in Kumar et al. includes scheduling of periodic voice slots for a link between a master and slave transmission on a wireless channel. Fig. 1 illustrates an envelope of incoming traffic to a wireless connection. The arrival and service curves are shown. A burst of maximum size arrives at a peak rate, after which, until the buffer is emptied, the arrivals are at an average rate.

In rejecting claim 1, the examiner refers to equation 1 of Kumar et al. This equation calculates a token rate based on a service rate, number of packets served in a wireless session, and a maximum packet length (see, for example, col. 5 and claim 1). Fig. 2 is a graph illustrating the basis on which the equation is derived. The graph shows the relationship between a polling interval and service quantum, service rate, and maximum bandwidth. Equation 1 is not used to calculate a burst-rate traffic profile. Instead, it is used to calculate a token rate.

The Examiner also cites col. 2, lines 30-67 of Kumar et al. As noted, at col. 2, lines 48, all of the parameters listed in col. 2 are mapped to a polling interval, which is the only parameter known to the scheduler.

Columns 7 and 8 of Kumar et al. describe calculation of the period of composite task from the link layer parameters of the forward and reverse link. The equation at line 46 of col. 7, for example, is used to ensure that maximum tolerable delay is not crossed by either connection. There is no teaching in Kumar et al. of calculating a periodic worst-case delay for a burst-rate traffic profile.

Furthermore, applicant respectfully submits that there is no suggestion to combine the teachings of Aoki et al. with Kumar et al. Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. Aoki et al. are concerned with a device for measuring performance in TCP and UDP communications. They obtain performance indexes of a round trip based on direct measurements of packets transmitted and received at a network device. In contrast, Kumar et al. disclose a scheduling methodology for connections within a wireless network based on polling intervals.

Accordingly, claim 1 is submitted as patentable over Aoki et al. and Kumar et al.

Claims 2-4, 6-8, and 32-41, depending either directly or indirectly therefrom, are submitted as patentable for the same reasons as claim 1.

Claim 6 is further submitted as patentable over Aoki et al. and Kumar et al., which do not show or suggest calculating a periodic worst-case delay by dividing a burst parameter by an allocated bandwidth associated with a queue. In rejecting claim 6, the Examiner refers to col. 17, lines 4-40, 54-68 and col. 18, lines 1-20 of the Aoki et al. patent. Col. 17 describes a method for calculating available bandwidth. For example, lines 31-35 describe when a transfer speed  $P$  of a

measurement oriented packet exceeds an upper limit of available bandwidth of a route, the available bandwidth can be presumed to be less than the transfer speed ( $E/\delta$ ). Col. 18 discusses judging whether or not the speed of the measurement-oriented packet exceeds available bandwidth of a route by checking whether or not the round trip times of the measurement-oriented packet has a certain relationship to the round trip times of other measurement-oriented packets. There is no discussion in Aoki et al. of calculating a worst-case delay by dividing a burst parameter by an allocated bandwidth associated with a queue. As noted above, neither Aoki et al. nor Kumar et al. address calculating a worst-case delay for a burst-rate traffic profile. Furthermore, Aoki et al. are concerned with available bandwidth of a route rather than bandwidth associated with a specific queue.

Claim 9 is directed to a method of estimating worst-case queuing delay along a path. The method includes collecting a rate parameter and a burst parameter. As previously discussed, neither Aoki et al. nor Kumar et al. show or suggest calculating a periodic worst-case delay associated with the rate and burst parameters. Moreover, these references do not teach adding up a periodic worst-case delay associated with routers along a path, as required by claim 9.

Accordingly, claim 9 is submitted as nonobvious over the prior art of record.

Claim 11 specifies calculating a burst parameter and a burst-rate traffic profile, claims 14 and 27 require code that causes a processor to calculate a burst parameter and code that causes the processor to calculate a burst-rate traffic profile, and claim 23 specifies means for calculating a burst parameter for the collected traffic and means for calculating a burst-rate traffic profile. Claims 12, 14, 23, and 27 are submitted as patentable for at least the reasons discussed above with respect to claim 1. Claim 15, depending from claim 14, claim 24, depending from claim 23, and claim 27, depending from claim 26, are submitted as patentable for the same reasons as claims 14, 23, and 26 respectively.

Claims 20 and 29 specify code that causes the processor to receive burst and rate traffic parameters. Claim 25 requires means for periodically collecting rate and burst traffic parameters. Claim 31 specifies that the periodic worst-case delay is based on a burst parameter and a rate parameter. Claims 11, 26, 30, and 32 are submitted as patentable for the reasons previously discussed with respect to claim 9. Claim 22, depending from claim 20, is submitted as patentable for the same reasons as claim 20.

Claims 33, 34, 35, and 36 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Aoki et al. in view of Kumar et al., in further view of "Network Traffic Characterization Using Token Bucket Model" (Tang et al.). Applicant respectfully submits that Tang et al. do not remedy the deficiencies discussed above for the primary references.

### III. Conclusion:

For the foregoing reasons, Applicant believes that all of the pending claims are in condition for allowance and should be passed to issue. If the Examiner feels that a telephone conference would in any way expedite the prosecution of the application, please do not hesitate to call the undersigned at (408) 399-5608.

Respectfully submitted,



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